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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/040,224	01/02/2002	Ebrahim Andideh	42390P11353	2917

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EXAMINER

LEE, HSIEN MING

ART UNIT PAPER NUMBER

2823

DATE MAILED: 09/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/040,224

Applicant(s)

ANDIDEH, EBRAHIM

Examiner

Hsien-Ming Lee

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 April 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-13 and 15-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13 and 15-30 is/are rejected.
- 7) ☒ Claim(s) 1 and 3-12 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Remarks

1. Claims 1, 3-13 and 15-30 are pending in the application.
2. The 103(a) rejections to claims 1, 3-12 are withdrawn in response to applicant's amendment filed 4/16/03.

Claim Objections

3. Claims 1 (lines 3, 5, 8, 9) and 6-9 are objected to because of the following informalities: in-consistent term, i.e. "**non-organic** first barrier layer" versus "first barrier layer." (Emphasis added)

Grounds of Rejections

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 13, 15-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Andideh et al. (US 6,448,185) in view of Lamey et al. (US 5,045,870).

In re claim 13, 15-18 and 21-28, Andideh et al., in Figs. 1a-1i and related text, teach the claimed method of forming a semiconductor device as stated in the previous Office Action except forming a second barrier layer comprising silicon carbide on the surface of said first barrier layer.

However, Lamely et. al., in an analogous art of forming a semiconductor device, teach forming a first patterned conductive layer 19/17 on a dielectric material (i.e. 15 and an oxide, wherein the oxide layer is a layer under the layer 15) on a substrate 11 (Fig. 2B); forming a first barrier layer 21 comprising silicon nitride (col. 4, lines 4-5) on the surface of the first patterned conductive layer 19; forming a second barrier layer 23 comprising silicon carbide (col. 4, lines 4-5) on the surface of the first barrier layer 21, wherein the first 21 and second 23 barrier are formed by PECVD (col. 6, lines 55-57); forming an organic dielectric layer 25 on the surface of the second barrier layer 23; and forming a via through a first portion of the dielectric layer 17/15/10.

Therefore, at the time the invention was made, one of the ordinary skill in the art would have been motivated to modify the method of Andideh et al. by forming the second barrier layer comprising the silicon carbide as taught by Lamely et al. on the surface of the first barrier layer (silicon nitride) of Andideh et al., since by doing so it would minimize the probability of pinhole-alignment directly from one film to the adjacent film, thus making a relatively impervious combined film structure. (col. 6, lines 55-64, Lamely et al.)

In re claims 19 and 29, Andideh et al. in view of Lamely et al. fail to teach that the first barrier layer comprises between 1 nanometer and 7 nanometer of silicon nitride. However, the selection of the thickness of the first barrier layer is obvious because it is a matter of determining optimum process condition by routine experimentation as the aforementioned reason in the rejection to claim 9 in the previous Office Action.

In re claims 20 and 30, Andideh et al. in view of Lamely et al. still fail to teach that the second barrier layer comprises less than 200 nanometers of silicon carbide. However, the

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selection of the thickness of the second barrier layer is obvious because it is a matter of determining optimum process condition by routine experimentation as the aforementioned reason in the rejection to claim 10 in the previous Office Action.

Allowable Subject Matter

6. Claim 1 would be allowable if rewritten or amended to overcome the objection as set forth in this Office action.

7. Claims 6-9 would be allowable if rewritten to overcome the objection as set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

8. Claims 3-5 and 10-12 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. The following is a statement of reasons for the indication of allowable subject matter:

The closest prior art of record, Andideh et al to US 6,448,185, teach the related method as stated in the previous Office Action.

In contrast, Andideh et al neither teach nor suggest forming a second barrier of silicon carbide on a surface of the non-organic first barrier layer; forming one of the via and the trench through the second barrier layer followed by forming the one of the via and the trench through the non-organic first barrier layer with a single etch process; and the non-organic first barrier and the second barrier layers are to prevent diffusion of metal from the first patterned conductive layer into the dielectric layer.

Response to Arguments

10. Applicant's arguments filed 4./16/03 have been fully considered but they are not persuasive.

Applicant's arguments is on the ground that Lamey does not teach depositing the first barrier layer on a metal interconnect layer deposited on a substrate; depositing a dielectric layer on the second barrier layer and the barrier layers are not for the purpose of preventing diffusion from the metal into a dielectric. (second paragraph, page 9)

Contrary to the arguments, the term "a metal interconnect layer " is not recited in the rejected claims. Claim 13 (line 2) merely recites "forming a first patterned conductive layer on a dielectric material on a substrate." (Emphasis added)

Furthermore, Lamey **does** teach the claimed limitations, including depositing the first barrier layer 21 on a first patterned conductive layer 19/17 on a dielectric material (i.e. 15 and an oxide) on a substrate 11; and depositing a dielectric layer 25 on the second barrier layer 23.

As far as the function of the barrier layers (i.e. preventing diffusion from the metal into a dielectric) is concerned, the rejected claims 13 and 15-30 do not recite the limitation as asserted.

Therefore, the rejections as set forth in the previous Office Action is deemed proper.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

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MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-Ming Lee whose telephone number is 703-305-7341. The examiner can normally be reached on M-F (9:00 ~ 5:00).

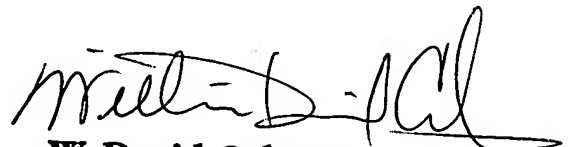
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Hsien-Ming Lee
Examiner
Art Unit 2823



Sep. 25, 2003



W. David Coleman
Primary Examiner